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TITLE: IN-VEHICLE AUTOMATED CALL ROUTING USING AN ORIGIN IDENTIFIER

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IN-VEHICLE AUTOMATED CALL ROUTING USING AN ORIGIN IDENTIFIER

FIELD OF THE INVENTION

This invention relates generally to wireless communications with a mobile vehicle. More specifically, the invention relates to a method and system for implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle.

BACKGROUND OF THE INVENTION

The opportunity to utilize wireless features in a mobile vehicle is ever increasing as the automobile is being transformed into a communications and entertainment platform as well as a transportation platform. Wireless features include wireless vehicle communication, networking, maintenance and diagnostic services for a mobile vehicle.

Typically, conventional wireless systems within mobile vehicles (e.g. telematics units) answer all incoming call signals. This occurs whether the vehicle is running or simply "awake" because of a programmed cycle. While this behavior has not been overly problematic in the recent past, it has in fact been necessary to ensure that data connectivity to the telematics unit is possible at all times. However, problems may occur in the implementation of new features, such as, for example Enhanced Call Forwarding.

Unfortunately, after a call has been answered by the telematics unit it can not be forwarded to voice-mail without employing a network-based solution, which has been shown to be costly and quite complex. It would be desirable, therefore, to provide a method and system that would overcome these and other disadvantages.

SUMMARY OF THE INVENTION

One aspect of the invention includes a method for operating a telematics unit within a mobile vehicle. The method includes receiving an incoming call signal including an origin identifier, determining an answer mode based on the origin identifier of the incoming call signal, initiating the answer mode responsive to the answer mode determination, and operating the telematics unit based on the initiated answer mode.

In accordance with another aspect of the invention, a computer readable medium storing a computer program includes: computer readable code for determining an answer mode based on an origin identifier included within an incoming call signal; computer readable code for initiating the answer mode responsive to the answer mode determination; and computer readable code for operating the telematics unit based on the initiated answer mode.

In accordance with yet another aspect of the invention, a system for operating a telematics unit within a mobile vehicle is provided. The system includes means for receiving an incoming call signal including an origin identifier. The system additionally includes means for determining an answer mode based on the origin identifier of the incoming call signal. Means for initiating the answer mode responsive to the answer mode determination is provided. Means for operating the telematics unit based on the initiated answer mode is also provided.

The aforementioned, and other features and advantages of the invention will become further apparent from the following detailed description of the presently preferred embodiments, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims and equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates one embodiment of a system for implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle, in accordance with one aspect of the current invention;

FIG. 2 is a flow diagram of one embodiment of a method of implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle, in accordance with one aspect of the current invention; and

FIG. 3 is a flow diagram of another embodiment of a method of implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle, in accordance with one aspect of the current invention.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG.1 illustrates one embodiment of system for data transmission over a wireless communication system, in accordance with the present invention at **100**. Mobile vehicle communication system (MVCS) **100** includes a mobile vehicle communication unit (MVCU) **110**, a vehicle communication bus **112**, a telematics unit **120**, one or more wireless carrier systems **140**, one or more communication networks **142**, one or more land networks **144**, one or more client, personal or user computers **150**, one or more web-hosting portals **160**, and one or more call centers **170**. In one embodiment, MVCU **110** is implemented as a mobile vehicle equipped with suitable hardware and software for transmitting and receiving voice and data communications. MVCS **100** may include additional components not relevant to the present discussion.

MVCU **110** may also be referred to as a mobile vehicle throughout the discussion below. In operation, MVCU **110** may be implemented as a motor vehicle, a marine vehicle, or as an aircraft. MVCU **110** may include additional components not relevant to the present discussion.

MVCU **110**, via a vehicle communication bus **112**, sends signals to various units of equipment and systems (detailed below) within MVCU **110** to perform various functions such as unlocking a door, opening the trunk, setting personal comfort settings, and calling from telematics unit **120**. In facilitating interactions among the various communication and electronic modules, vehicle communication bus **112** utilizes bus interfaces such as controller-area network (CAN), International Organization for Standardization (ISO) Standard 9141, J1850, ISO Standard 11898 for high-speed applications, ISO Standard 11519 for lower speed applications, and Society of Automotive Engineers (SAE) Standard J1850 for high speed and lower speed applications.

MVCU **110**, via telematics unit **120**, sends and receives radio transmissions from wireless carrier system **140**. Wireless carrier system **140** is implemented as any suitable system for transmitting a signal from MVCU **110** to communication network **142**.

Communication network **142** includes services from one or more mobile telephone switching offices and wireless networks. Communication network **142** connects wireless carrier system **140** to land network **144**. Communication network **142** is implemented as any suitable system or collection of systems for connecting wireless carrier system **140** to MVCU **110** and land network **144**.

Land network **144** connects communication network **142** to client computer **150**, web-hosting portal **160**, and call center **170**. In one embodiment, land network **144** is a public-switched telephone network (PSTN). In another embodiment, land network **144** is implemented as an Internet protocol (IP) network. In other embodiments, land network **144** is implemented as a wired network, an optical network, a fiber network, other wireless networks, or any combination thereof. Land network **144** is connected to one or more landline telephones. Communication network **142** and land network **144** connect wireless carrier system **140** to web-hosting portal **160** and call center **170**.

Client, personal or user computer **150** includes a computer usable medium to execute Internet browser and Internet-access computer programs for sending and receiving data over land network **144** and optionally, wired or wireless communication networks **142** to web-hosting portal **160**. Personal or client computer **150** sends user preferences to web-hosting portal through a web-page interface using communication standards such as hypertext transport protocol (HTTP), and transport-control protocol and Internet protocol (TCP/IP). In one embodiment, the data includes directives to change certain programming and operational modes of electronic and mechanical systems within MVCU **110**. In operation, a client utilizes computer **150** to initiate setting or re-setting of user-preferences for MVCU **110**. User-preference data from client-side software is transmitted to server-side software of web-hosting portal **160**. User-preference data is stored at web-hosting portal **160**.

Web-hosting portal **160** includes one or more data modems **162**, one or more web servers **164**, one or more databases **166**, and a network **168**. Web-hosting portal **160** is connected directly by wire to call center **170**, or connected by phone lines to land network **144**, which is connected to call center **170**. In an example, web-hosting portal **160** is connected to call center **170** utilizing an IP network. In this example, both components, web-hosting portal **160** and call center **170**, are connected land network **144** utilizing the IP network. In another example, web-hosting portal **160** is connected to land network **144** by one or more data modems **162**. Land network **144** sends digital data to and from modem **162**, data that is then transferred to web server **164**. Modem **162** may reside inside web server **164**. Land network **144** transmits data communications between web-hosting portal **160** and call center **170**.

Web server **164** receives user-preference data from user computer **150** via land network **144**. In alternative embodiments, computer **150** includes a wireless modem to send data to web-hosting portal **160** through a wireless communication network **142** and a land network **144**. Data is received by land network **144** and sent to one or more web servers **164**. In one embodiment, web server **164** is implemented as any suitable hardware and software capable of providing web services to help change and transmit personal preference settings from a client at computer **150** to telematics unit **120** in MVCU **110**. Web server **164** sends to or receives from one or more databases **166** data transmissions via network **168**. Web server **164** includes computer applications and files for managing and storing personalization settings supplied by the client, such as door lock/unlock behavior, radio station present selections, climate controls, custom button configurations and theft alarm settings. For each client, the web server potentially stores hundreds of preferences for wireless vehicle communication, networking, maintenance and diagnostic services for a mobile vehicle.

In one embodiment, one or more web servers **164** are networked via network **168** to distribute user-preference data among its network components such as database **166**. In an example, database **166** is a part of or a separate computer from web server **164**. Web server **164** sends data transmissions with user preferences to call center **170** through land network **144**.

Call center **170** is a location where many calls are received and serviced at the same time, or where many calls are sent at the same time. In one embodiment, the call center is a telematics call center, facilitating communications to and from telematics unit **120** in MVCU **110**. In an example, the call center is a voice call center, providing verbal communications between an advisor in the call center and a subscriber in a mobile vehicle. In another example, the call center contains each of these functions. In other embodiments, call center **170** and web-hosting portal **160** are located in the same or different facilities.

Call center **170** contains one or more voice and data switches **172**, one or more communication services managers **174**, one or more communication services databases **176**, one or more communication services advisors **178**, and one or more network **180**.

Switch **172** of call center **170** connects to land network **144**. Switch **172** transmits voice or data transmissions from call center **170**, and receives voice or data transmissions from telematics unit **120** in MVCU **110** through wireless carrier system **140**, communication network **142**, and land network **144**. Switch **172** receives data transmissions from and sends data transmissions to one or more web-hosting portals **160**. Switch **172** receives data transmissions from or sends data transmissions to one or more communication services managers **174** via one or more network 180.

Communication services manager **174** is any suitable hardware and software capable of providing requested communication services to telematics unit **120** in MVCU **110**. Communication services manager **174** sends to or receives from one or more communication services databases **176** data transmissions via network system **180**. Communication services manager **174** sends to or receives from one or more communication services advisors **178** data transmissions via network system **180**. Communication services database **176** sends to or receives from communication services advisor **178** data transmissions via network system **180**. Communication services advisor **178** receives from or sends to switch **172** voice or data transmissions.

Communication services manager **174** provides one or more of a variety of services, including enrollment services, navigation assistance, directory assistance, roadside assistance, business or residential assistance, information services assistance, emergency assistance, and communications assistance. Communication services manager **174** receives service-preference requests for a variety of services from the client via computer **150**, web-hosting portal **160**, and land network **144**. Communication services manager **174** transmits user-

preference and other data to telematics unit **120** in MVCU **110** through wireless carrier system **140**, communication network **142**, land network **144**, voice and data switch **172**, and network system **180**. Communication services manager **174** stores or retrieves data and information from communication services database **176**. Communication services manager **174** may provide requested information to communication services advisor **178**.

In one embodiment, communication services advisor **178** is implemented as a real advisor. In an example, a real advisor is a human being in verbal communication with a user or subscriber (e.g. a client) in MVCU **110** via telematics unit **120**. In another embodiment, communication services advisor **178** is implemented as a virtual advisor. In an example, a virtual advisor is implemented as a synthesized voice interface responding to requests from telematics unit **120** in MVCU **110**.

Communication services advisor **178** provides services to telematics unit **120** in MVCU **110**. Services provided by communication services advisor **178** include enrollment services, navigation assistance, real-time traffic advisories, directory assistance, roadside assistance, business or residential assistance, information services assistance, emergency assistance, and communications assistance. Communication services advisor **178** communicate with telematics unit **120** in MVCU **110** through wireless carrier system **140**, communication network **142**, and land network **144** using voice transmissions, or through communication services manager **174** and switch **172** using data transmissions. Switch **172** selects between voice transmissions and data transmissions.

Telematics unit **120** includes a digital signal processor (DSP) **122** connected to a wireless modem **124**, a global positioning system (GPS) unit **126**, an in-vehicle memory **128**, a microphone **130**, one or more speakers **132**, origin identifier module **134**, and an embedded or in-vehicle mobile phone **136**. In other embodiments, telematics unit **120** may be implemented without one or more of the above listed components, such as, for example GPS unit **126** and speakers **132**. DSP **122** further includes vehicle information controller **123**. Telematics unit **120** may include additional components not relevant to the present discussion.

In one embodiment, DSP **122** is implemented as a microcontroller, controller, host processor, or vehicle communications processor. In an example, DSP **122** is implemented as an application specific integrated circuit (ASIC). Vehicle information controller **123** is a software module that facilitates the reception and implementation of commands from a MVCS **100** controller, such as, for example call center **170**. In an example, commands from call center **170** include vehicle-side system updates. In another example, commands from call center **170** include user preference updates. In another embodiment, vehicle information controller **123** is implemented as a hardware module (not shown), in communication with DSP **122**, including software that facilitates the reception and implementation of commands from call center **170**. GPS unit **126** provides longitude and latitude coordinates of the vehicle responsive to a GPS broadcast signal received from a one or more GPS satellite broadcast systems (not shown). In-vehicle mobile phone **136** is a cellular-type phone, such as, for example an analog, digital, dual-mode, dual-band, multi-mode or multi-band cellular phone.

DSP **122** executes various computer programs that control programming and operational modes of electronic and mechanical systems within MVCU **110**. DSP **122** controls communications (e.g. call signals) between telematics unit **120**, wireless carrier system **140**, and call center **170**. In one embodiment, a voice-recognition application is installed in DSP **122** that can translate human voice input through microphone **130** to digital signals. DSP **122** generates and accepts digital signals transmitted between telematics unit **120** and a vehicle communication bus **112** that is connected to various electronic modules in the vehicle. In one embodiment, these digital signals activate the programming mode and operation modes, as well as provide for data transfers. In this embodiment, signals from DSP **122** are translated into voice messages and sent out through speaker **132**.

Origin identifier module **134** Includes hardware and software to detect and identify origin identifiers included within communications between telematics unit **120**, wireless carrier system **140**, and call center **170**. Examples of origin identifiers include automatic number identifiers and digital signatures. Digital signature is a form of cryptography that appends extra data to a message that identifies and authenticates the sender and message data using public or private encryption key methods. Encryption key methods are well known to practitioners in the art. In one embodiment, origin identifier module **134** is implemented as an independent hardware component and associated software that is interfaced with DSP **122**. In another embodiment, origin identifier module **134** is implemented as a hardware component and associated software that is embedded within DSP **122**.

The origin identifier included within the communication is sent to DSP **122** for processing. DSP **122** determines and initiates one of several answer modes responsive to the received origin identifier. Each answer mode is associated with predetermined group of origin identifiers. In one embodiment, the answer modes are associated with a predetermined group of origin identifiers provided by a MVCS **100** controller, such as, for example call center **170**. The predetermined group of origin identifiers is stored within DSP **122**, such as, for example in a look-up table within DSP **122** or within a component of DSP **122**. In another embodiment, one or more of the answer modes is associated with one or more predetermined groups of origin identifiers provided within user-preference data. In an example, one or more of the answer modes is associated with one or more predetermined groups of origin identifiers provided by a client via computer **150** and call center **170** and stored within DSP **122**.

In operation, each answer mode provides operating parameters for directing an incoming call signal. In one embodiment, two answer modes are provided by a mobile vehicle communication system controller. The first answer mode is associated with a predetermined group of origin identifiers that are compared to the origin identifier within the incoming call signal. If the origin identifier within the incoming call signal matches any of the predetermined group of origin identifiers, the first answer mode is initiated. In this embodiment, when the first answer mode is initiated the incoming call signal is directed and connected to vehicle information controller **123** located within telematics unit **120**, such as, for example within DSP **122**. Connecting the incoming call to vehicle information controller **123** allows reception and implementation of commands from call center **170**, such as, for example vehicle updates.

In this embodiment, the second answer mode is associated with all remaining origin identifiers. If the origin identifier within the incoming call signal does not match any of the predetermined group of origin identifiers, the second answer mode is initiated. In this embodiment, when the second answer mode is initiated, the incoming call signal is directed to a user interface. In an example, if the origin identifier in the incoming call signal does not match any of the predetermined group of origin identifiers, the incoming call signal is directed to a user interface within the mobile vehicle, such as, in-vehicle mobile phone **136**. In this embodiment, the incoming call signal is connected to the user interface if a user activates the user interface. Alternatively, if the user interface is not activated, the incoming call signal is directed to an electronic voice-mail system. In an example, if the user interface is not activated, the incoming call signal is directed to an electronic voice-mail system by an associated phone service provider.

In other embodiments, additional origin identifiers are provided as well as associated answer modes, such as, for example by the client. In these embodiments, each answer mode provides additional operating parameters for directing the incoming call signal(s). In an example, a client provides additional answer modes and associated origin identifiers to telematics unit **120** via computer **150** and call center **170**. In this example, a client provides one or more origin identifiers and associates one or more answer modes to the origin identifiers, such as, providing a list of origin identifiers that the client desires to be sent directly to the electronic voice-mail system by an associated phone service provider. The additional answer modes provide greater flexibility to the client as well as the system provider.

FIG. 2 is a flow diagram of an embodiment of a method of implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle. In **FIG. 2**, method **200** may utilize one or more systems detailed in **FIG. 1** above. The present invention can also take the form of a computer usable medium including a program for configuring an electronic module within a vehicle. The program stored in the computer usable medium includes computer program code for executing the method steps described in **FIG. 2**. In **FIG. 2**, method **200** begins at step **210**.

At step **220**, an incoming call signal, including an origin identifier, is received at a telematics unit within a mobile vehicle. Examples of origin identifiers include an automatic number identifier, a digital signature. In an example and referring to **FIG. 1** above, an incoming call signal, including an origin identifier, in mobile vehicle communication system (MVCS) **100** is received at DSP **122** within mobile vehicle communication unit (MVCU) **110**.

At step **230**, an answer mode is determined based on the origin identifier of the incoming call signal. In one embodiment, determining the answer mode includes determining a first answer mode when the origin identifier is within a predetermined group of origin identifiers and determining a second answer mode when the origin identifier is not within the predetermined group of origin identifiers. In an example and referring to **FIG. 1** above, the incoming call signal is routed to origin identifier module **134** that detects and identifies an origin identifier included within the incoming signal. The detected origin identifier is then sent to DSP **122** for processing. DSP **122** processes the origin identifier and determines if the origin identifier is included within a predetermined group of origin identifiers associated with the first answer mode. If the origin identifier is not included within a predetermined group of origin identifiers associated with the first answer mode, then DSP **122** determines the second answer mode is the answer mode.

In other embodiments, additional answer modes are provided as well as associated predetermined groups of origin identifiers. In these embodiments, each answer mode provides additional operating parameters for directing the incoming call signal(s) as described in **FIG. 1**, above.

At step **240**, the determined answer mode is initiated. In one embodiment, the first answer mode is initiated when DSP **122** determines that the origin identifier is within a predetermined group of origin identifiers. In this embodiment, the second answer mode is initiated when DSP **122** determines that the origin identifier is not within a predetermined group of origin identifiers.

At step **250**, the telematics unit operates based on the initiated answer mode. In one embodiment, operating the telematics unit based on the first answer mode includes directing the incoming call signal to a vehicle information controller within the telematics unit. In this embodiment, operating the telematics unit based on the first answer mode additionally includes connecting the incoming call signal to the vehicle information controller within the telematics unit. In an example and referring to **FIG. 1** above, operating telematics unit **120** based on the first answer mode includes directing and connecting the incoming call signal to a vehicle information controller **123** within telematics unit **120**.

In another embodiment, operating the telematics unit based on the second answer mode includes directing the incoming call signal to a user interface within the telematics unit. In this embodiment, operating the telematics unit based on the second answer mode additionally includes connecting the incoming call signal to the user interface within the telematics unit responsive to a user interface activation. In an example and referring to **FIG. 1** above, operating telematics unit **120** based on the second answer mode includes directing and connecting the incoming call signal to a user interface, such as, in-vehicle mobile phone **136** within telematics unit **120** responsive to a user interface activation.

In yet another embodiment, operating the telematics unit based on the second answer mode includes directing the incoming call signal to a user interface within the telematics unit. In this embodiment, operating the telematics unit based on the second answer mode additionally includes determining the user interface is not activated and activating an electronic voice-mail system. In an example, operating the telematics unit based on the second answer mode includes determining the user interface, such as, in-vehicle mobile phone **136** is not activated and activating an electronic voicemail system as described in **FIG. 1**, above.

At step **260**, the method ends.

FIG. 3 is a flow diagram of another embodiment of a method of implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle. In **FIG. 3**, method **300** may utilize one or more systems detailed in **FIG. 1** above. The present invention can also take the form of a computer usable medium including a program for configuring an electronic module within a vehicle. The program stored in the computer usable medium includes computer program code for executing the method steps described in **FIG. 3**. In **FIG. 3**, method **300** begins at step **310**.

At decision step **320**, a determination is made as to if an origin identifier, such as, for example an automatic number identifier (ANI) is included within an incoming call signal. If there is an origin identifier within the incoming call signal, method **300** advances to step **360**. If there is not an origin identifier within the incoming call signal, method **300** advances to step **325**.

At decision step **360**, a determination is made as to if the origin identifier is within a call center identified range of origin identifiers. If the origin identifier is within the call center identified range of origin identifiers, method **300** advances to step **325**. If the origin identifier is not within the call center identified range of origin identifiers, method **300** advances to step **365**.

At step **325**, the mobile vehicle communication unit (MVCU) automatically answers the incoming call signal. At decision step **330**, a determination is made as to if a modem is present or functioning, such as, for example if "modem tones" are present. If the modem is present and functioning, method **300** advances to step **340**. If the modem is not present or is not functioning, or is present and functioning but not producing "modem tones," method **300** advances to step **350**.

At step **340**, the telematics unit within the MVCU enters a data mode, such as, for example to receive data from the call center. At step **350**, the telematics unit within the MVCU enters a voice mode such as, for example to receive a voice transmission from the call center.

At step **365**, the telematics unit directs and connects the incoming call signal to a vehicle information controller that initiates ring tones within the mobile vehicle. At decision step **370**, a determination is made as to if the incoming call signal is answered within a preset amount of time, such as, for example within a determined amount of rings. If the incoming call signal is answered within a preset amount of time, method **300** advances to step **380**. If the incoming call signal is not answered within a preset amount of time, method **300** advances to step **390**.

At step **380**, the incoming call signal is connected to a user interface for execution. At step **380**, the incoming call signal is forwarded to an electronic voicemail system. In another embodiment, the incoming call signal is routed to an electronic voicemail system by the call signal provider for voicemail execution.

The above-described methods and implementation for implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle are example methods and implementations. These methods and implementations illustrate one possible approach for implementing automated call routing using an origin identifier within a telematics equipped mobile vehicle. The actual implementation may vary from the method discussed. Moreover,

various other improvements and modifications to this invention may occur to those skilled in the art, and those improvements and modifications will fall within the scope of this invention as set forth in the claims below.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive.